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## **Accessibility and Infrastructure in The City of Frederick**

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## **Executive Summary**

This report analyzes pedestrian and bus accessibility in the City of Frederick using three methods: geospatial analysis, cataloging photographs and surveys. ArcMap was used to map the locations of four vulnerable populations: the elderly, renters, minorities, and those with low vehicle ownership. This information was overlaid with a quarter-mile walkshed from Frederick County TransIT bus lines to identify neighborhoods that are both high risk and appear to have limited accessibility. After identifying neighborhoods, the team cataloged and geocoded the existing neighborhood infrastructure. Finally, a survey of City residents gathered information about their attitudes and habits about riding the bus and walking as a means of transportation. The report's findings are mixed: bus accessibility and usage is low, while the City excels in walking infrastructure and accessibility.

## About Frederick

Amid cities like Annapolis and Baltimore, and a spattering of densely populated District of Columbia suburbs, Frederick is a city that is often forgotten in the State of Maryland. Ironically, Frederick is arguably more of a city than many of the others. Covering 22 square miles with a population of 65,000, Frederick is the State's second largest incorporated city. The City is the county seat of Frederick County and home to Hood College and Fort Detrick, a U.S. Army biomedical research complex. As the county seat, many government agencies, such as the Board of Education and both City and County government offices, are located in the City of Frederick. Frederick is uniquely located within an hour's drive of Washington D.C. to the south and Baltimore to the east.

## Research Question

The objective of this research project is to identify the City of Frederick's pedestrian and bus accessibility. This was done by looking at both walking conditions and patterns, as well as investigating issues pertaining to the Frederick County TransIT bus service. Our preliminary hypothesis was that both pedestrian and bus accessibility within the City were poor for two reasons. First, with an area of 22 square miles, the City is much larger than a downtown district and has few corridors, making it likely that some areas of the City would lack proper infrastructure, perhaps due to funding issues or different priorities. Second, Frederick is somewhat geographically isolated. There are a few job centers within the City, primarily Fort Detrick, followed by the Frederick County government offices. Aside from those employers, many residents commute to either the Baltimore or D.C. area for work, requiring a personal automobile. The estimated high level of car ownership led us to believe that other modes of transportation may not be used as they are in more metropolitan cities. These two assumptions made us anticipate that walkability wouldn't exist within the City and that bus riding would be minimal.

## **Existing Infrastructure**

The City's public transit infrastructure consists of 11 routes of the Frederick County TransIT bus service. Four of the routes are strictly Monday through Friday service, while the others run Monday through Saturday. There is no Sunday service. According to the Frederick County Department of Public Works and Transportation, the fiscal year 2014 total ridership for all lines combined was 802,566. This number is ridership for the whole county, not just the segments of service that cross into the City. This data also shows a decrease in ridership over the past two years. The bus lines serve many, but not all sections of the City. It should be noted that the team's accessibility analysis used 2010 Census data and accordingly, the team used TransIT bus routes that were in place before a 2010 update, as more representative of the effects the system may have on the City's characteristics.

## **Methods**

Three different technologies were used to investigate the team's research question. The first used ArcMap, a geographic information system, to create a watershed, based on the TransIT lines that enter into the City. That information was overlaid with City neighborhoods with vulnerable populations, also identified through ArcMap, to identify areas with limited bus accessibility. Second, the team visited those areas with vulnerable populations and limited TransIT access and manually cataloged and uploaded images onto Flickr, where the photos could be both stored and geocoded. Finally, the team's conducted a survey about transportation habits and attitudes to persons spending an afternoon in downtown Frederick.

## **WATERSHEDS AND GEOSPATIAL ANALYSIS**

As part of the analysis, the team created a quarter mile watershed using ArcGIS to assess different characteristics of the City neighborhoods and their proximity to public transit. The watershed was created using ArcMap's network analyst tool, which allowed us to create a watershed using the City's street network.

The first step was the to create a network dataset from a Tigerline Census shapefile of the roads in Frederick County, which allowed the network analyst to use the street network. The

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dataset included a restriction for highways so that the walkshed would not allow the buffer to include highways as pedestrian routes. This made the walkshed more realistic for pedestrian traffic.

The next step was to create a point feature class from the TransIT bus lines file using the “construct points” tool in the editor toolbar. The points were put at 30-foot intervals along the bus routes. Converting the lines into tightly packed points allows the creation of a linear walkshed since you cannot use line features. These points were loaded into a service area analysis as the facilities from which the walksheds would be derived from. Finally, the service area analysis was run to create a quarter mile walkshed around the bus lines.

To identify neighborhoods with vulnerable populations, the team looked at five characteristics: city zoning, percentage of non-white population in each block group, percentage of population 60 years or older in each block group, percentage of renters in each block group, and percentage of vehicle ownership for each Census tract. These characteristics were visualized using thematic maps and then overlaid with the TransIT system’s quarter mile walkshed to get an idea of who can access the bus system, as well as help to designate points of interest for further field investigation.

Map 1 shows the City zoning (see Appendix A). The busyness of the map makes it difficult to obtain clear information, so the percentages of each type of zoning within the walkshed are shown in Table 1.

*Table 1: Percent of Zoning in Walkshed*

Zoning Type	Percentage
Open Space	3.2%
Residential	52.8%
Office	11.9%
Mixed Use	3.2%
Commercial	22.0%
Manufacturing	6.4%
Institutional	0.5%

Residential zoning takes up most of the walkshed, at over 50 percent, followed by commercial zoning at 22 percent. The fact that these two are the most frequent zoning types shows that the bus line mainly connects residents to shopping opportunities inside the City. However, it is important to note that the bus line also connects to some jobs in the office and manufacturing sectors, at 11.9 and 6.4 percent respectively. This indicates that people could take TransIT to and from work, however without more information on where the employees of these industries are coming from, it cannot be confirmed.

Map 2 (Appendix A) shows the percentage of the City's non-white population. This information is visualized at the block group level and the map shows that the higher percentages of non-white population in Frederick are concentrated in the southwestern section of the City, yet the area is well covered by the bus walkshed.

Map 3 (see Appendix A) shows the percentage of renters in each block group. This map gave insight into areas to further investigate on the team's field visit. Two distinctive dark brown spots, indicating high renter populations, appear on the map; one lies along the western edge, the other in the center of the City. The majority of these block groups fall outside of the quarter mile walkshed.

Map 4 (see Appendix), showing the elderly population (60 years and over), confirmed the need to investigate the dark brown block along the City's western edge, as it has high elderly and renting populations. There is also a small offshoot of the City, seen in the southeast portion of the map, which shows a high concentration of both renters and elderly populations, therefore designating it as a location for further investigation.

Finally, Map 5 (see Appendix A), shows the percentage of residents who own a vehicle within the City, indicating car ownership patterns in Frederick. Most of the census tracts within the City have over 90 percent vehicle ownership. This is true even within the walksheds of the bus lines. However, most of the census tracts completely contained within the bus walksheds do report lower vehicle ownership percentages.

These maps helped the team identify three census block groups for further field assessment. The first is located along the City's western edge; the second is just south of Fort

Detrick and the third is a small block group in the City's southeastern portion. Map 6 (see Appendix A) shows these block groups.

## **WINDSHIELD SURVEYS AND FLICKR**

While the ArcGIS walkshed helped determine walkability based on pedestrian infrastructure near Frederick's public transit system, the team determined that a complete observer windshield survey technique to understand components of Frederick's pedestrian infrastructure would provide context for the walkshed. In addition, this surveying process helped provide a layer of qualitative data to support, deny or explain the walkshed.

On November 23, 2014, the team visited Frederick to conduct a windshield survey of the three pre-determined vulnerable areas of the City. As a companion to a windshield survey, the team used the photo-sharing application, Flickr to record and map its findings regarding pedestrian infrastructure. For this report, sidewalk typologies were photographed along the windshield survey routes. Some of those typologies consisted of:

- whether or not a sidewalk existed
- if the sidewalk was well maintained
- if the sidewalk was continuous
- whether the sidewalk was protected
- whether the sidewalk was ADA (Americans with Disabilities Act) compliant with handicap accessible ramps and warning pads at crossings
- whether street crossings were equipped with adequate paint demarcations, which force automobiles to yield to pedestrians in a crosswalk per Maryland law.

A data-capable Google tablet was used to take pictures of pedestrian infrastructure in the Flickr application. Photos were taken roughly every two or three blocks in the area adjacent to vulnerable regions. Flickr image goals were to record pedestrian infrastructure quality within the six categories listed above. The team's Flickr images and photomap can be found at: <https://www.flickr.com/photos/128835651@N06/sets/72157649795482722/map?&lat=39.4177&lon=-77.4053&z=14&order=recent>.



The team began with the two vulnerable areas immediately adjacent to Fort Detrick. This survey began moving west, along Shookstown Road and Montevue Lane, moved southeast along Rosemont Avenue, then northeast on Military Road and southeast on West 7<sup>th</sup> Street. Our first realization upon viewing the site near Fort Detrick was that the census block group vulnerability components were skewed. The assumption was that the most vulnerable census block group comprised residential land uses, when in reality the block group was primarily land owned by Fort Detrick. Nevertheless, we continued the windshield survey. Flickr images taken along the corridor were primarily of sidewalk and road crossings.

Given that the windshield study areas were designated as vulnerable, our hypothesis was that pedestrian infrastructure would be substandard. The team assumed that most roads in these areas would lack pedestrian infrastructure. To our surprise, the entirety of the northwest vulnerable area was fully equipped with pedestrian infrastructure. Based on Flickr records and the six-category infrastructure criteria, all sidewalks within the area were successful. Sidewalks consistently existed along the routes on at least one side of the street. Sidewalks were always well maintained; they were free of debris and had few cracks that might be hazardous to pedestrians. Some sidewalks along Shookstown Road were protected from fast moving traffic by metal guardrails, while most others had a landscaped strip between the sidewalk and road. All sidewalks were somewhat ADA compliant; all road crossings were equipped with ramps, though some ramps lacked ADA warning pads used to assist blind pedestrians. Painted crosswalks did exist for sidewalk crossings with arterials, but not for small residential streets.

The third vulnerable area in the City's southeast, adjacent to the Maryland Area Regional Commuter (MARC) rail yard, was determined to be less vulnerable upon visiting the site. Most of the census block group was devoted to industrial uses. Despite this, the team continued with the windshield survey and Flickr recording. This area was surveyed in a way similar to the northwest areas. The survey route primarily followed South Street west out of the Frederick's downtown.

Unlike the northwest areas, the southeast lacked most pedestrian infrastructure outside the downtown core. Most sidewalks did not exist at all. When sidewalks did exist, they were not continuous and hardly well maintained. Sidewalks also lacked protection from automobile traffic and were not ADA compliant at any crosswalks.

Qualitative research regarding the quality of pedestrian infrastructure was incredibly important to our comprehension of walkability in the City of Frederick. The windshield survey allowed us to provide a companion to the walkshed. The survey initially helped to explain why our Census-determined vulnerable areas were less vulnerable in reality based on actual land-use types. In addition, the survey demonstrated that The City's pedestrian infrastructure disproved our hypothesis about vulnerable areas lacking good quality pedestrian infrastructure. Using Flickr as a primary means of recording sidewalk typologies not only streamlined the tediousness of manually sifting through photographs, the application allowed us to create a more useful, interactive presentation for community members interested in walkability in their neighborhoods.

## **TRANSPORTATION SURVEYS**

To access attitudes about the TransIT bus service as well as walking, our team took to the streets of Frederick to survey local residents. The team spent over an hour on a sunny Sunday afternoon canvassing the streets of downtown Frederick. A Google Form was created with questions pertaining to usage and opinions on walking and riding the bus, and responses were gathered in real time on tablets. All in all, 28 people responded to the survey. On average, it took about six minutes to complete each survey, which asked the following questions:

- Do you, or anyone currently residing in your household, own a vehicle?
- Have you ever used the Frederick County TransIT bus service?
- When was the last time you used the Frederick County TransIT bus service?
- In an average week, how frequently do you use the Frederick County TransIT bus service?
- When you ride the Frederick County TransIT bus service, how long, on average, is a one-way journey?
- Where do you take the Frederick County TransIT bus service to?
- Why do you use the Frederick County TransIT bus service?
- Why have you not used the Frederick County TransIT bus service?
- Do you think that the City of Frederick is a "walkable" community?
- Do you ever walk as a means of transportation to get from one place to another?
- In an average week, how frequently do you walk as a means of transportation?

- When you walk as a means of transportation, how long, on average, is a one-way trip?
- When you walk as a means of transportation, where do you walk to?
- Why do you walk as a means of transportation?
- Why do you not walk as a means of transportation?
- What would cause you to walk more as a means of transportation?
- As of today, how long have you lived in the City of Frederick?
- What is your zip code?

Survey results indicated that very few people have ever rode Frederick's bus system, and just one rides with any frequency. Sixty percent of those who have ever rode TransIT haven't done so in more than two months. More telling than responses from those who have ridden are the responses from those who have not. Owning a personal vehicle was overwhelmingly the reason why people stated that they didn't use public transit; not surprising given that 96.4 percent of those surveyed indicated that their households owned at least one car. The car ownership statistic wasn't particularly shocking given Frederick's relatively isolated geography from transit and jobs nodes. Many times during our visit, our group made remarks about how essential a car would be to get around the 22-square mile city.

Questions regarding walking showed much more positive results. Nearly 97 percent of respondents indicated that they see The City of Frederick as a walkable community. This number was backed up by the windshield survey of walking infrastructure in selected neighborhoods, which showed an abundance of sidewalks in impeccable condition.

Eighty-five percent of respondents said that they walk as a means of transportation, even when taking the health and exercise benefits associated with walking out of the picture. Seventy percent walk at least once a week to get to a destination, with walks ranging from 5-15 minutes and 16-30 minutes being the most frequently selected length of each trip. It seems that people walk a variety of places in Frederick. Retail and dining establishments took a strong lead with 17 selections; however not far behind were public parks and institutions, grocery stores and visiting others. Main motives for walking included enjoying the mode of transport, living near interesting destinations and the ease of walking, especially when compared to parking.

Parking came up multiple times as an issue that the team wasn't expecting. Nowhere on the survey did we mention anything about parking, either in the questions or answer options, yet numerous people stated that parking can be an issue in the City. When probed, respondents noted that parking issues included the difficulty of finding a parking space or the cost of parking. Two respondents stated that these parking issues are why they walk, as opposed to drive, in the downtown core. It should be noted that this isn't necessarily a bad thing. Walking is good for the City's businesses and residents as it improves health, lessens carbon footprint and stimulates activities along streets.

Finally, respondents were asked how long they've lived in Frederick and for their zip code. Nearly 43 percent of those we talked with don't actually live in the City, but were taking a day-trip—great news for the City. This survey clearly demonstrated that Frederick is a destination for many in the area, a great position for a city to have. Of those who did claim residence, there was a range of tenure, from three months to 31 years; Frederick is both attracting and maintaining its citizens.

It is interesting to note that 16 people said they lived in the City, yet according to their zip codes, not all of them live within City limits. In reviewing individual answers it became clear that they live nearby, not inside the City. For example, two respondents listed their zip code as 21703, a zip code that lies mostly in the Ballenger Creek area, though a small portion does cross city limits. In this case, it's impossible to know from the available information, if those respondents actually live within the City, or just outside and associate themselves with the City. Another respondent provided a zip code associated with Virginia, however answered that they've lived in Frederick for three months. It's likely that this person had recently moved to Frederick, but responded with an older zip code.

A complete list of responses to each of the questions can be found in Appendix B.

## **Conclusion and Recommendations**

The synthesis of all three methods used to assess accessibility and infrastructure in the City of Frederick disproved the team's hypothesis. Initially the team thought that Frederick would have poor walking infrastructure and lack access to public transportation, yet the opposite proved to be

true. The majority of the surveyed area showed an excellent pedestrian realm. Most streets had sidewalks that were properly constructed, free of debris and impediments and were ADA compliant. In some instances there was even a landscaped buffer area between the road and sidewalk to further ease the pedestrian experience. Survey results supported this conclusion, with the vast majority of respondents agreeing that Frederick is a walkable city and high numbers of residents walking as a means of transportation on a regular basis.

The industrial area in the City's southeast portion was the only place the team experienced incomplete sidewalk infrastructure. It is debatable how important fixing those sidewalks are, as it's an industrial area unlikely to be accessed on foot with regularity, however this quick fix would be the final piece to a complete sidewalk foundation in Frederick.

Similarly, the team was impressed by TransIT bus coverage. The areas that held high concentrations of vulnerable populations and didn't appear to have much access according to our walkshed turned out to be slightly skewed data. Two of these areas were rural lots owned by Fort Detrick, with a small population; in the data it appeared to be a more isolated and vulnerable area than it actually is. Very few areas with high populations lacked access to a bus stop within a ¼-mile radius. Bus stops were clearly marked with signage indicating the bus route, and were located on well-kept sidewalks. Bus stops closer to the downtown core included shelters and benches.

To make the study more relevant to the City and its residents, we compared bus accessibility in the Neighborhood Action Committee neighborhoods (see Map 7, Appendix A). This analysis divides the City into two neighborhood types, bus accessible and inaccessible. This approach could be useful in discussing the needs of different areas of the City as well as providing a way to pinpoint neighborhood groups for feedback on different issues and initiatives.

As noted earlier, the team used 2010 Census data and 2010 TransIT service maps. In summer 2012, Frederick County expanded TransIT service, adding an additional north-south bus line through the Fort Detrick area—an area our original analysis had reported as having low bus accessibility. This crucial addition connected those two block groups to the greater framework of public transportation in The City of Frederick. This is particularly impressive given the relatively low ridership for the TransIT service.

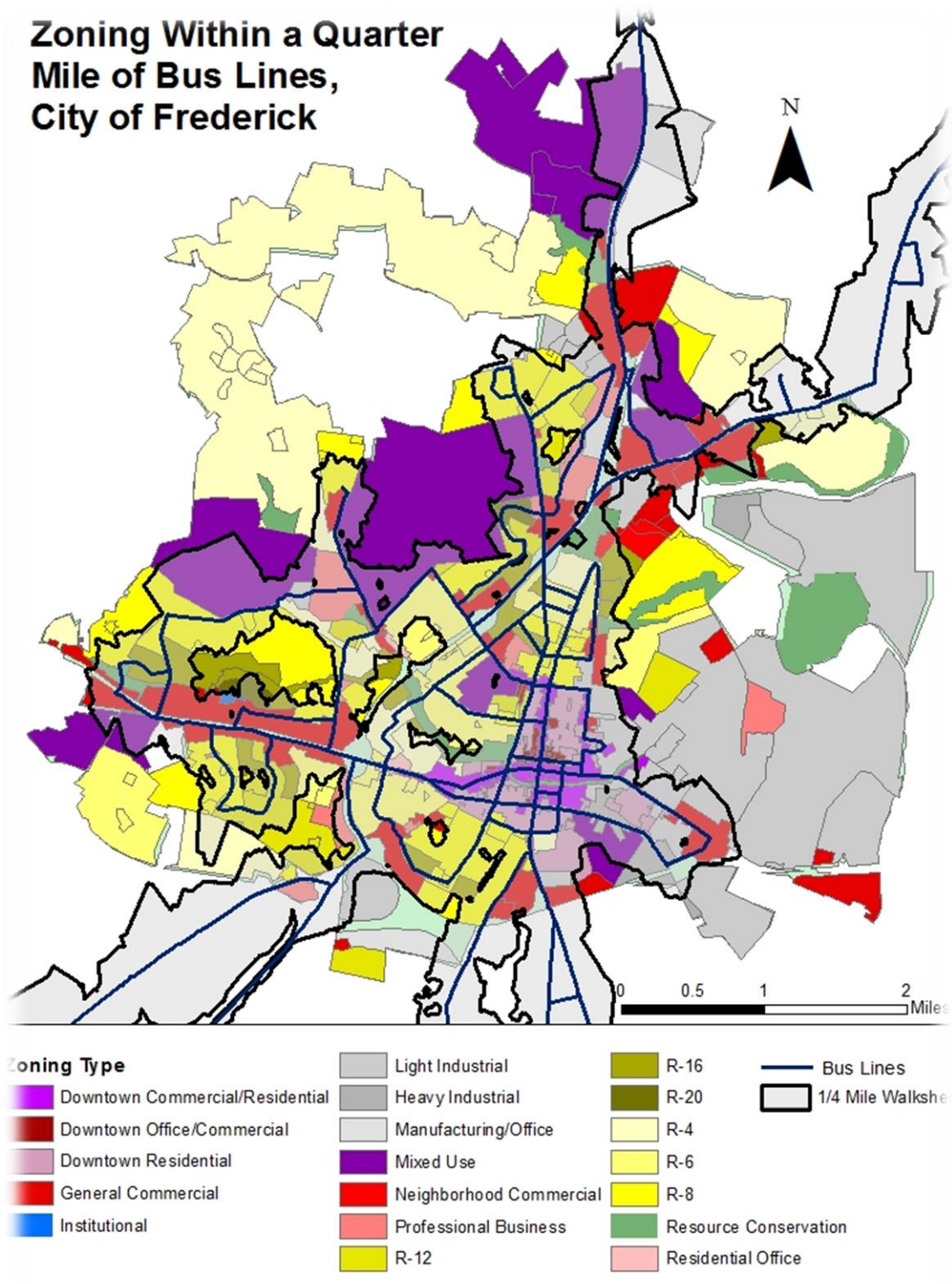
The team is pleased to note that its original hypothesis was turned on its head and recommendations are limited. The City of Frederick should consider:

- Completing the sidewalk infrastructure in the southeast block group (Map 6, Appendix A). Adding sidewalks to this area will complete the infrastructure throughout the entire City, setting a best practice for other jurisdictions to follow. The City should continue with the high quality and ADA compliance seen elsewhere in Frederick.
- A campaign to inform and encourage TransIT use. A staggering number (82 percent) of surveyed respondents indicated that they had never rode TransIT, yet many of them complained about issues with parking downtown or not living close enough to walk to destinations. A few respondents didn't know bus service existed, so education and encouragement may increase ridership. Even if half of those individuals took TransIT once a week, it could amount to a significant decrease in automobile dependence and usage.
- Focusing economic development initiatives around retail, dining, parks, and institutional uses to maximize foot traffic and activity. These land use areas got the most foot traffic, according to our survey and could also be good places to provide educational information about the City and TransIT services.

The City of Frederick is doing an incredible job at making the City a warm, welcoming and walkable place for residents and visitors alike. They've clearly placed an emphasis on accessibility and infrastructure for pedestrians and transit users—a commendable feat which many municipalities overlook. The City should be proud of this reputation and promote itself as a locale proud to be accessible for all of its residents.

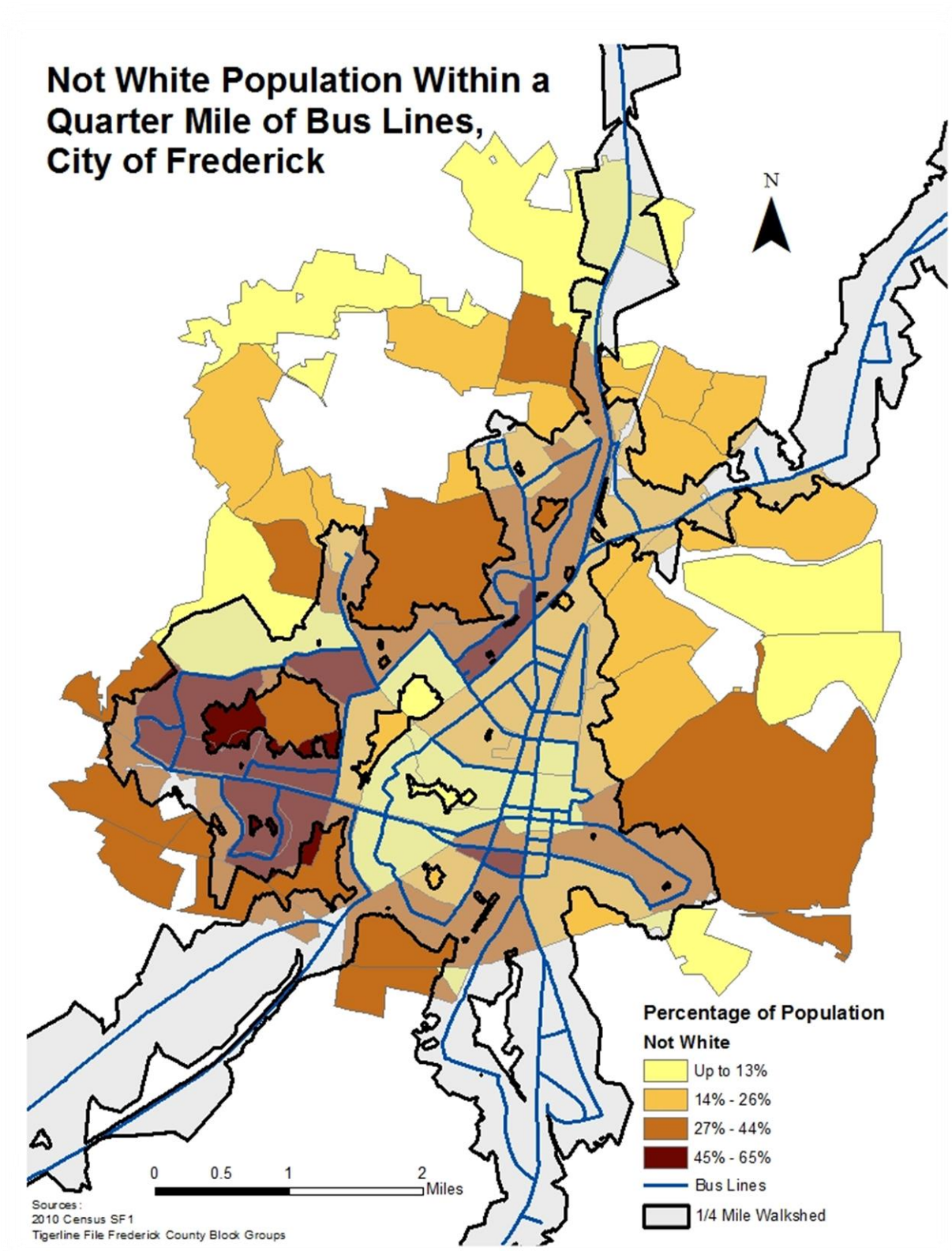
## Appendix A: Maps

Map 1



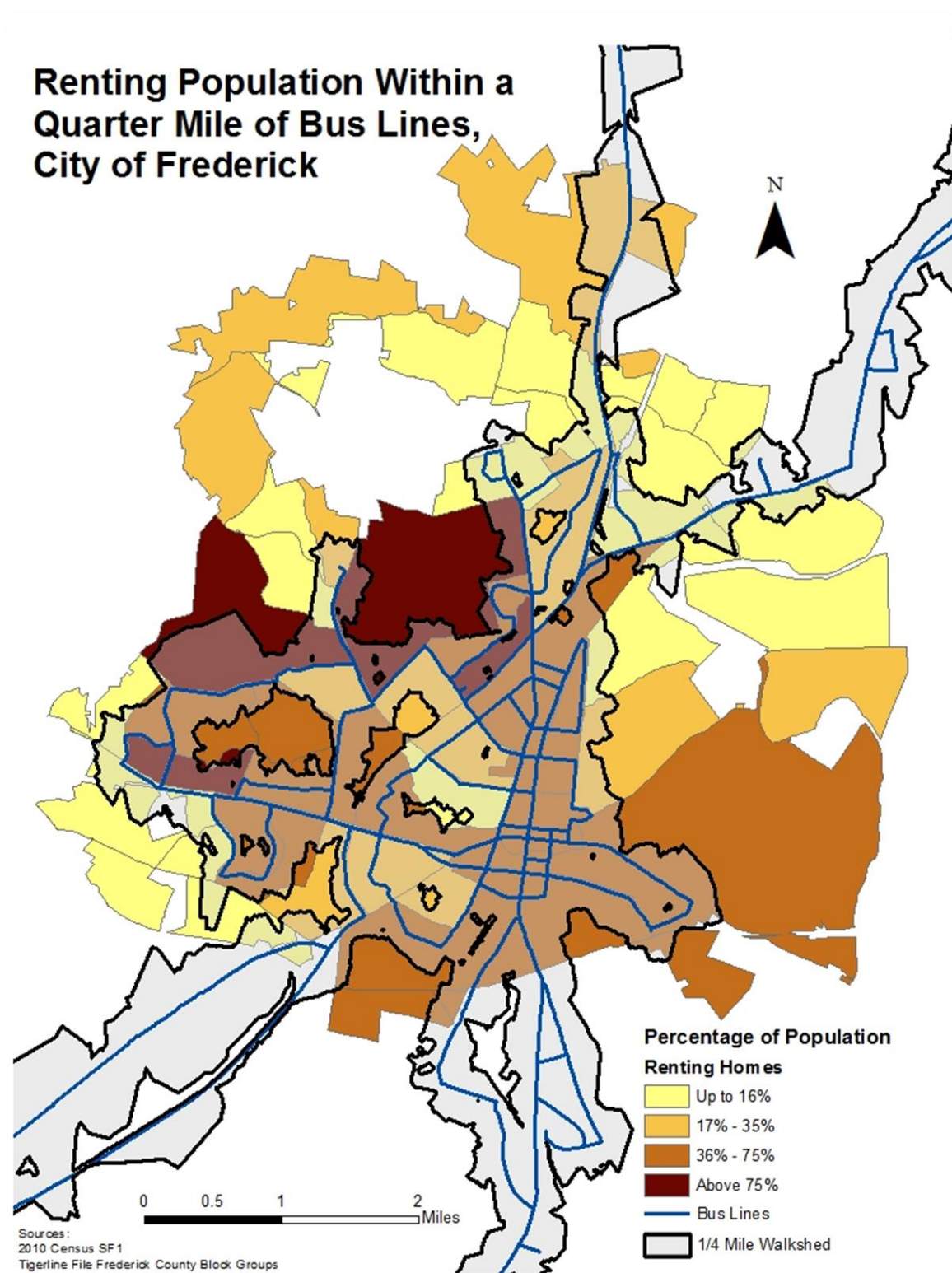


Map 2

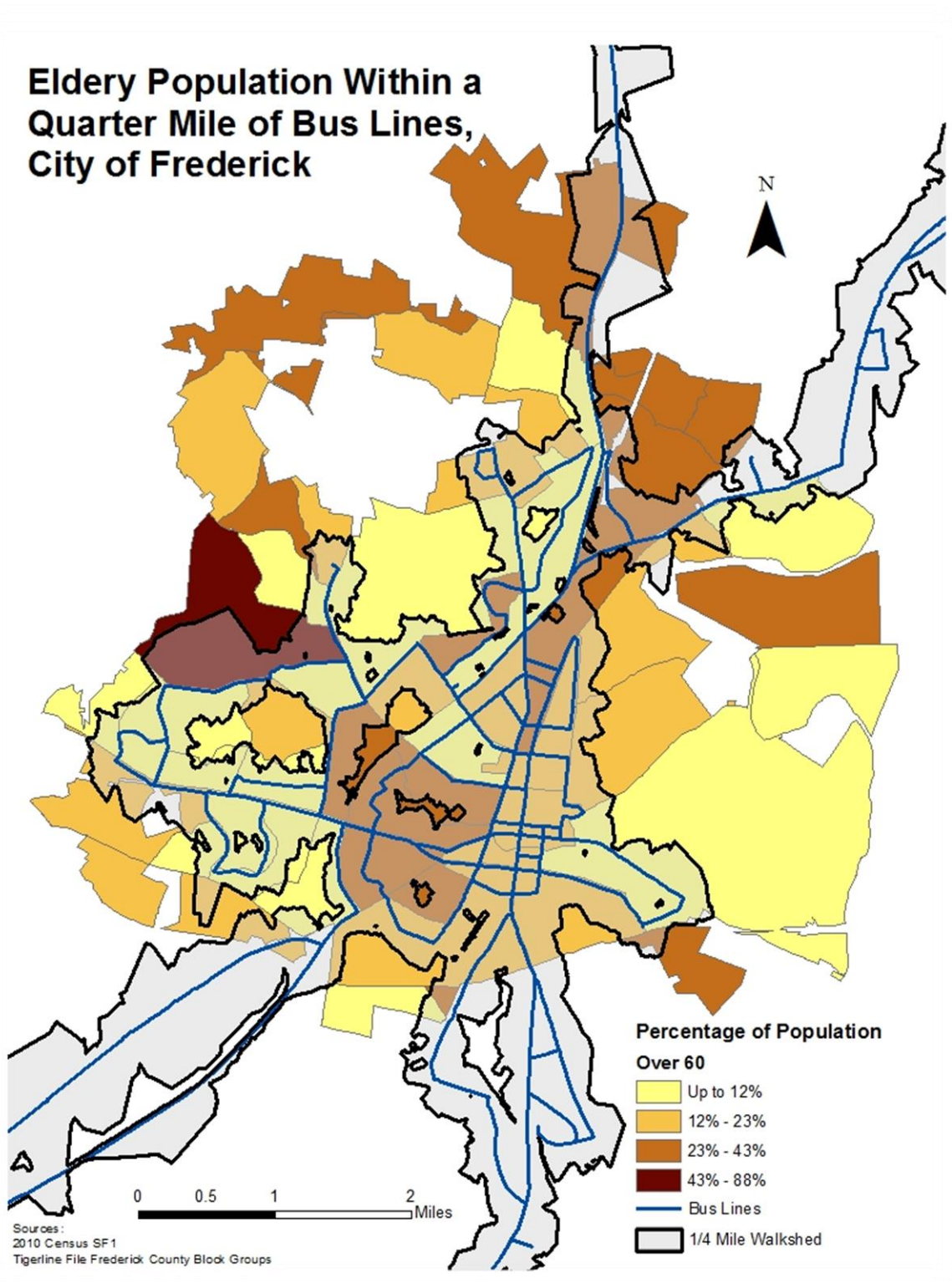




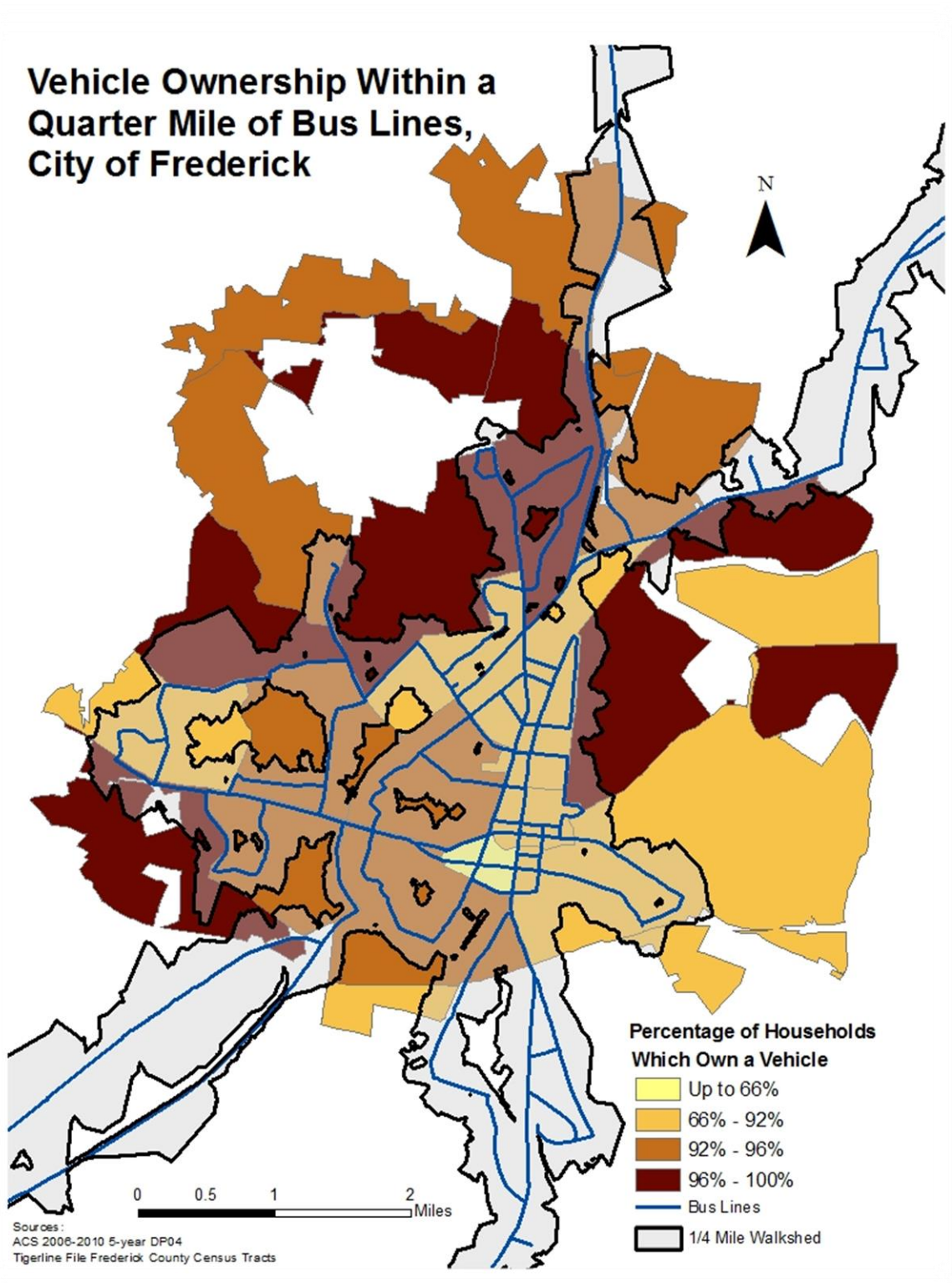
Map 3



Map 4

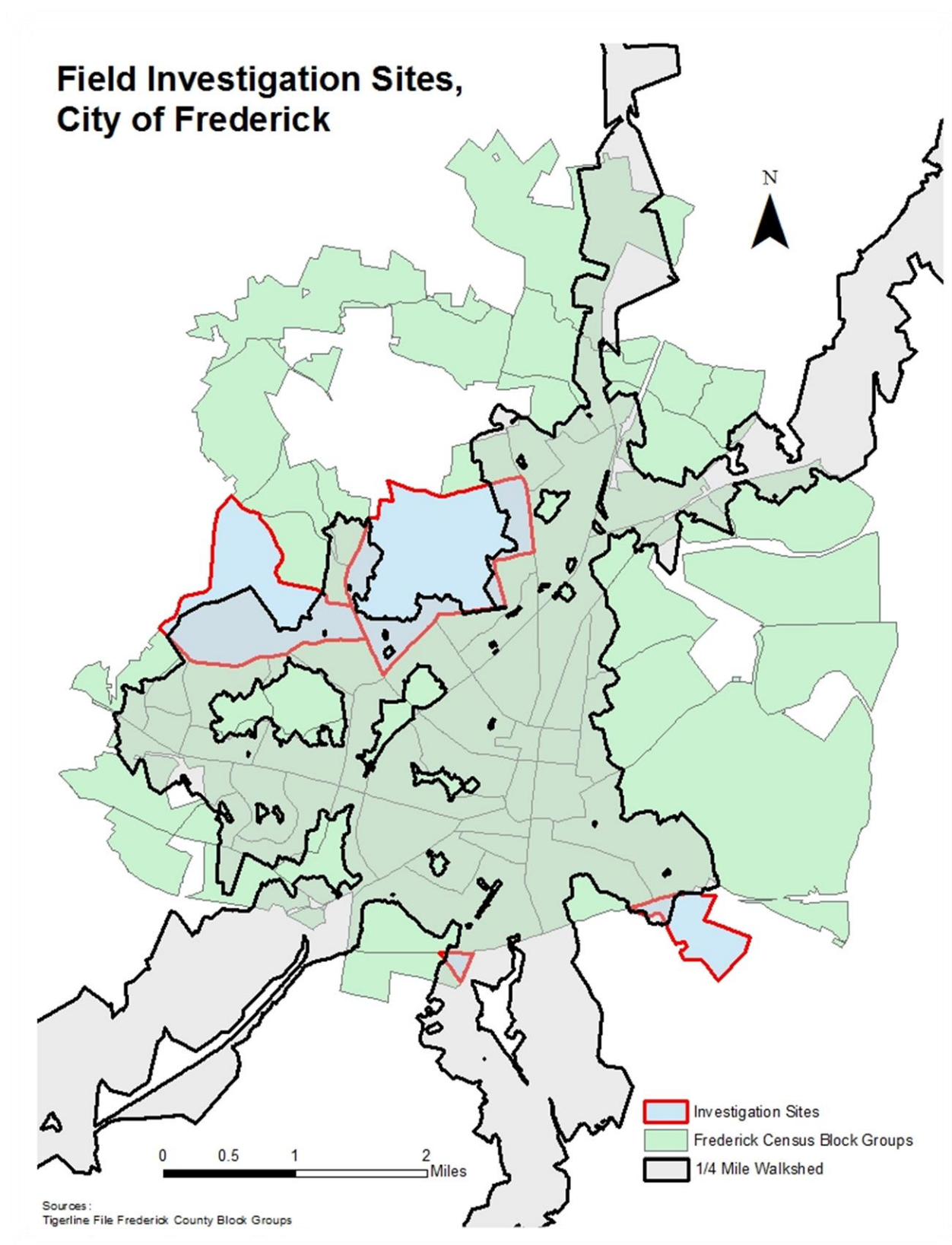


Map 5



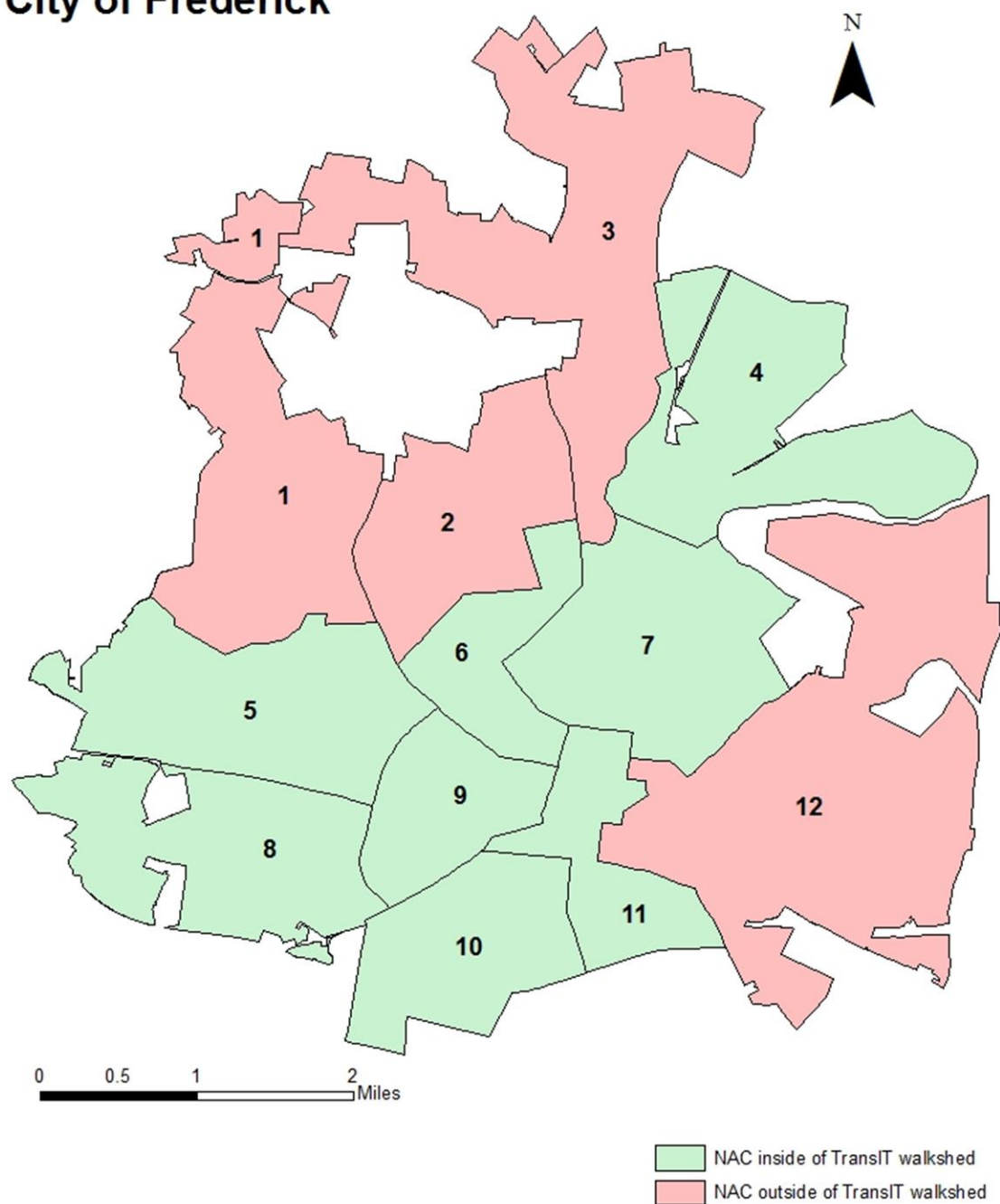


Map 6



Map 7

## Neighborhood Advisory Committee Bus Accessibility, City of Frederick



## Appendix B: Survey Responses

The following chart records the responses to questions asked in the survey conducted in downtown Frederick on Sunday, November 22, 2014. Questions that were mandatory or that had mutually exclusive answers are listed in both number of respondents and percentages. Questions with “write in” options or where many answers could be selected, are recorded by the number of responses.

Question	Top Responses
Do you, or anyone currently residing in your household, own a vehicle?	Yes: 27 (96.4%) No: 1 (3.6%)
Have you ever used the Frederick County TransIT bus service?	Yes: 5 (17.9%) No: 24 (82.1%)
When was the last time you used the Frederick County TransIT bus service (if applicable)?	Longer than 2 months: 3 (60%) In the past month: 1 (20%) In the past week: 1 (20%)
In an average week, how frequently do you use the Frederick County TransIT bus service (if applicable)?	Less than 1 trip: 4 (80%) 2-4 trips: 1 (20%)
When you ride the Frederick County TransIT bus service, how long, on average, is a one-way journey (if applicable)?	5-10 minutes: 2 (40%) 16-20 minutes: 1 (20%) 31-45 minutes: 1 (20%) Greater than 60 minutes: 1 (20%)
Where do you take the Frederick County TransIT bus service to (if applicable)?	Retail and dining: 3 Work: 2 Grocery shopping: 1 Home: 1 Public parks, institutions, etc.: 1
Why do you use the Frederick County TransIT bus service (if applicable)?	Car did not work: 1 The bus is quick: 1 The bus is affordable: 1 The bus is convenient: 1 I don't own a car: 1
Why have you not used the Frederick County TransIT bus service (if applicable)?	I have a car: 15 I'm not from Frederick: 9 I walk where I need to go: 5 I'm not comfortable on the bus: 3 The bus doesn't service destinations I'm interested in: 3 Safety concerns: 1

	Previous bad experience: 1
Do you think that the City of Frederick is a "walkable" community?	Yes: 27 (96.4%) No: 1 (3.6%)
Do you ever walk as a means of transportation to get from one place to another?	Yes: 24 (85.7%) No: 4 (14.3%)
In an average week, how frequently do you walk as a means of transportation (if applicable)?	2-4 times a week: 8 (33.3%) Less than once a week: 7 (29.2%) More than 10 times a week: 5 (20.8%) 1 trip a week: 2 (8.3%) 5-10 times a week: 2 (8.3%)
When you walk as a means of transportation, how long, on average, is a one-way trip (if applicable)?	5-15 minutes: (45.8%) 16-30 minutes: (33.3%) Less than 5 minutes: 2 (8.3%) 31-45 minutes: 2 (8.3%) Greater than 60 minutes: 1 (4.2%)
When you walk as a means of transportation, where do you walk to (if applicable)?	Retail and dining: 17 Public parks, institutions, etc.: 10 Home: 8 Visit others: 8 Grocery store: 7 Work: 6
Why do you walk as a means of transportation (if applicable)?	I enjoy walking: 14 I live near destinations: 6 Walking is easy: 4 Parking issues in the City: 2 I have no car: 2 Walking saves gas: 1
Why do you not walk as a means of transportation (if applicable)?	I don't live walking distance to destinations: 2 I have a car: 1 I'm not comfortable walking: 1 I don't enjoy walking: 1
What would cause you to walk more as a means of transportation?	If I lived/worked closer to activity: 7 If parking was more expensive: 2 If there was better lighting: 1 If I didn't have a car: 1
As of today, how long have you lived in the City of Frederick?	Not a Frederick resident: 12 (42.9%) More than 10 years: 5 (17.8%) Less than 1 year: 4 (14.2%) 3-5 years: 4 (14.2%) 6-10 years: 2 (7.2%) 1-2 years: 1 (3.6%)

What is your zip code?	21701: 11 21702: 2 21703: 2 21704: 1 20755: 1 21771: 1 22032: 1 22014: 1 37042: 1 20782: 1 20874: 1 20886: 1 20901: 1 21228: 1 21234: 1 Not given: 1
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